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EXAMINER	
KIM, TAE JUN	

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3741	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/624,754	COSTE, KEITH	
	Examiner	Art Unit	
	Ted Kim	3741	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-20 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-20 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 1-20 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. In claims 1 and 17, the claims require "the control valve passing a first amount of propellant in the first state during a first time period and *passing a second amount of propellant in a second state during a second time period*." However, the specification, claim 2 and a later portion of claim 17 specifically indicates that the second state is when the valve is closed and thus the valve is incapable of passing propellant during this second time period. Thus the claims are not believed to be literally possible.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1-6, 11, 13, 15 are rejected under 35 U.S.C. 102(b) as being anticipated by Runavot (5,117,627). Runavot teaches a catalytic decomposition propulsion system, the system comprising, a propellant tank 12 for storing a propellant, a control valve 1 for controlling the passage of the propellant, the control valve 1 (see abstract and e.g. col. 3, lines 1+) operating in a first [open] state and a second [closed] state, the control valve passing a first amount of propellant in the first state during a first time period and passing a second amount of propellant in a second state during a second time period, the first amount being greater than the second amount, and a decomposition chamber 15 for supporting a catalyst 4 for reacting with the propellant for decomposing the propellant into a gas; wherein, the first state is an opened state, the second state is a closed state, and the second amount of propellant passed through the control valve during the second time is zero; wherein, the valve is continuously operated between the first and second states; wherein, the valve timing is inherently capable of allowing a majority of the sum of the first amount plus the second amount of the propellant passed through the control valve during the first and second time period decomposes during the second time period; wherein, the valve timing is inherently capable of allowing ninety percent of the sum of the first amount plus the second amount of the propellant passed through the control valve during the first and second time period decomposes during the second time period; wherein, a current rate of decomposition of propellant in the decomposition chamber inherently increases when the control valve changes from the first state to the second state; further comprising, a nozzle for exhausting the gas from the decomposition

chamber; further comprising, an injector (near 3) inlet for passing the propellant from the control valve 1 into the decomposition chamber; further comprising, a distribution manifold 11 disposed between the propellant tank and the control valve; wherein, the propellant is a monopropellant.

5. Claims 1-9, 11, 13, 15 are rejected under 35 U.S.C. 102(b) as being anticipated by Speeds et al (4,162,292). Speeds et al teach a catalytic decomposition propulsion system, the system comprising, a propellant tank 16 for storing a propellant, a control valve 22 for controlling the passage of the propellant, the control valve 22 operating in a first state [on] and a second state [off], the control valve passing a first amount of propellant in the first state during a first time period and passing a second amount of propellant in a second state during a second time period, the first amount being greater than the second amount [the valve is pulsed between on and off, see col. 3, lines 14+; col. 4, lines 45+], and a decomposition chamber 26 for supporting a catalyst for reacting with the propellant for decomposing the propellant into a gas; wherein, the first state is an opened state [on], the second state is a closed state [off], and the second amount of propellant passed through the control valve during the second time is zero; wherein, the valve is continuously operated between the first and second states; wherein, the valve timing is inherently capable of operating such that a majority of the sum of the first amount plus the second amount of the propellant passed through the control valve during the first and second time period decomposes during the second time period; wherein, the valve timing is inherently capable of operating such that ninety percent of the sum of the first amount

plus the second amount of the propellant passed through the control valve during the first and second time period decomposes during the second time period; wherein, a current rate of decomposition of propellant in the decomposition chamber increases when the control valve changes from the first state to the second state; wherein the decomposition chamber comprises, a plurality of chamber bed 28, 26 having respectively sized particles of the catalyst; wherein the decomposition chamber comprises, a plurality of chamber beds having respectively sized particles of the catalyst, the chamber beds being graduated across a flow path through the decomposition chamber ; further comprising, an injector manifold 24 deposed between the decomposition chamber 26 and the flow control valve 22, the injector manifold having a plurality of injector orifices 24 for distributing the propellant into the decomposition chamber; further comprising, a nozzle 50 for exhausting the gas from the decomposition chamber; further comprising, an injector inlet for passing the propellant from the control valve into the decomposition chamber; further comprising, a distribution manifold 18 disposed between the propellant tank and the control valve.

6. Claims 1-7, 9, 11, 13, 15, 17 are rejected under 35 U.S.C. 102(b) as being anticipated by Ellion et al (4,490,<u>972</u>) and incorporated by reference Ellion (4,324,**096**). Ellion et al '<u>972</u> teach a catalytic decomposition propulsion system, the system comprising, a propellant tank [not shown, see col. 2, lines 27+] for storing a propellant, a control valve 8 for controlling the passage of the propellant, the control valve operating in a first state and a second state, the control valve passing a first amount of propellant in

the first state during a first time period and passing a second amount of propellant in a second state during a second time period, the first amount being greater than the second amount, and a decomposition chamber (66, 68, **see Ellion '096**) for supporting a catalyst 66, 68 for reacting with the propellant for decomposing the propellant into a gas; wherein, the first state is an opened state, the second state is a closed state, and the second amount of propellant passed through the control valve during the second time is zero; wherein, the valve is continuously operated between the first and second states; wherein, a majority of the sum of the first amount plus the second amount of the propellant passed through the control valve during the first and second time period decomposes during the second time period [note that Fig. 6 shows that the time off, i.e. between pulses, can be much greater than the time on the pulses and thus the long time period between pulses will clearly accommodate more decomposition than the short time period of the pulses themselves]; wherein, the valve timing is inherently capable of operating such that ninety percent of the sum of the first amount plus the second amount of the propellant passed through the control valve during the first and second time period decomposes during the second time period; wherein, a current rate of decomposition of propellant in the decomposition chamber inherently increases when the control valve changes from the first state to the second state; wherein the decomposition chamber comprises, a plurality of chamber bed having respectively sized particles of the catalyst; wherein the decomposition chamber comprises, a plurality of chamber beds (**see Ellion '096**) having respectively sized particles of the catalyst, further comprising, an injector manifold (89,

see Ellion '096) deposed between the decomposition chamber and the flow control valve, the injector manifold having a plurality of injector orifices 90, 92 for distributing the propellant into the decomposition chamber; further comprising, a nozzle 56 for exhausting the gas from the decomposition chamber; further comprising, a nozzle for exhausting the gas from the decomposition chamber, the nozzle having convergent portion, divergent portion and a throat portion, further comprising, an injector inlet for passing the propellant from the control valve into the decomposition chamber; further comprising, a distribution manifold 32 disposed between the propellant tank and the control valve, wherein, the propellant is a monopropellant: wherein, the propellant comprises hydroxyl ammonium nitrate. A catalytic decomposition propulsion system, the system comprising, a propellant tank [not shown] for storing a propellant, a control valve 18 for controlling the passage of the propellant, the control valve operating in a first state and a second state, the control valve passing a first amount of propellant in the first state during a first time period and passing a second amount of propellant in a second state during a second time period, the first amount being greater than the second amount, a decomposition chamber 66, 68 (**see Ellion '096**) for supporting a catalyst for reacting with the propellant for decomposing the propellant into a gas, and an injector manifold 89 (**see Ellion '096**) deposed between the decomposition chamber and the flow control valve, the injector manifold having a plurality of injector orifices (90, 92 **see Ellion '096**) for distributing the propellant into the decomposition chamber, and a nozzle 56 for exhausting the gas from the decomposition chamber, the nozzle having convergent

portion, divergent portion and a throat portion, wherein: the first state is an opened state; the second state is a closed state; the second amount of propellant passed through the control valve during the second time is zero; the valve is continuously operated between the first and second states; a majority of the sum of the first amount plus the second amount of the propellant passed through the control valve during the first and second time period decomposes during the second time period [inherent, as the second time period can be much longer than the first time period]; and a current rate of decomposition of propellant in the decomposition chamber increases when the control valve changes from the first state to the second state; wherein the decomposition chamber comprises, a plurality of chamber beds having respectively sized particles of the catalyst, the chamber beds being graduated across a flow path through the decomposition chamber.

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 1-7, 9, 11, 13, 15, 17 are rejected under 35 U.S.C. 102(b) as being anticipated by Ellion et al (4,490,<u>972</u>) and incorporated by reference Ellion (4,324,**096**). The ranges for operation of the valve and thus the decomposition timing was regarded as inherent or taught by Ellion. To the extent that it is not specifically disclosed, it is regarded as an obvious matter of finding the workable ranges in the art as Ellion

specifically controls the valve timing in a manner analogous to applicant. It would have been obvious to one of ordinary skill in the art to control the valve timing to perform the specific functions of decomposition during the second time period, >90% decomposition, etc. as an obvious matter of finding the workable ranges in the art.

9. Claims 1-9, 11, 13, 15-17, 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Berg et al (6,931,832) in view of Ellion et al (4,490,972) and incorporated by reference Ellion (4,324,**096**). Berg et al teach a thruster (see Fig. 1) with a catalytic decomposition propulsion system, the system comprising, a propellant tank 24 for storing a propellant, a control valve 32 for controlling the passage of the propellant, the control valve 32 operating in a first state [open] and a second state [closed], see e.g. col. 3, lines 2-6 and col. 4, lines 54+ which teach there are a number of cycles of operation of the valve, the control valve passing a first amount of propellant in the first state during a first time period and passing a second amount of propellant in a second state during a second time period, the first amount being greater than the second amount, and a decomposition chamber 60 for supporting a catalyst for reacting with the propellant for decomposing the propellant into a gas; wherein, the first state is an opened state, the second state is a closed state; wherein, the propellant is a monopropellant: wherein, the propellant comprises hydroxyl ammonium nitrate (see col. 1, lines 39+). Berg et al teach the use of cycles for the valve using discrete pulses, but not their timing nor the use of plural catalyst beds nor the injector and manifold structure. Ellion et al teach the use of pulsed on-off cycles for the valve using with the adjustable timing to prevent impulse bit

degradation and enhanced performance, the use of plural catalyst beds, the injector and manifold structure. Ellion et al '972 teach a catalytic decomposition propulsion system, the system comprising, a propellant tank [not shown, see col. 2, lines 27+] for storing a propellant, a control valve 8 for controlling the passage of the propellant, the control valve operating in a first state and a second state, the control valve passing a first amount of propellant in the first state during a first time period and passing a second amount of propellant in a second state during a second time period, the first amount being greater than the second amount, and a decomposition chamber (66, 68, **see Ellion '096**) for supporting a catalyst 66, 68 for reacting with the propellant for decomposing the propellant into a gas; wherein, the first state is an opened state, the second state is a closed state, and the second amount of propellant passed through the control valve during the second time is zero; wherein, the valve is continuously operated between the first and second states; wherein, a majority of the sum of the first amount plus the second amount of the propellant passed through the control valve during the first and second time period decomposes during the second time period [note that Fig. 6 shows that the time off, i.e. between pulses, can be much greater than the time on the pulses and thus the long time period between pulses will clearly accommodate more decomposition than the short time period of the pulses themselves]; wherein, the valve timing is inherently capable of operating such that ninety percent of the sum of the first amount plus the second amount of the propellant passed through the control valve during the first and second time period decomposes during the second time period; wherein, a current rate of decomposition of

propellant in the decomposition chamber inherently increases when the control valve changes from the first state to the second state; wherein the decomposition chamber comprises, a plurality of chamber bed having respectively sized particles of the catalyst; wherein the decomposition chamber comprises, a plurality of chamber beds (**see Ellion '096**) having respectively sized particles of the catalyst, further comprising, an injector manifold (89, **see Ellion '096**) deposed between the decomposition chamber and the flow control valve, the injector manifold having a plurality of injector orifices 90, 92 for distributing the propellant into the decomposition chamber; further comprising, a nozzle 56 for exhausting the gas from the decomposition chamber; further comprising, a nozzle for exhausting the gas from the decomposition chamber, the nozzle having convergent portion, divergent portion and a throat portion, further comprising, an injector inlet for passing the propellant from the control valve into the decomposition chamber; further comprising, a distribution manifold 32 disposed between the propellant tank and the control valve, wherein, the propellant is a monopropellant: wherein, the propellant comprises hydroxyl ammonium nitrate. A catalytic decomposition propulsion system, the system comprising, a propellant tank [not shown] for storing a propellant, a control valve 18 for controlling the passage of the propellant, the control valve operating in a first state and a second state, the control valve passing a first amount of propellant in the first state during a first time period and passing a second amount of propellant in a second state during a second time period, the first amount being greater than the second amount, a decomposition chamber 66, 68 (**see Ellion '096)** for supporting a catalyst for

reacting with the propellant for decomposing the propellant into a gas, and an injector manifold 89 (**see Ellion '096**) deposed between the decomposition chamber and the flow control valve, the injector manifold having a plurality of injector orifices (90, 92 **see Ellion '096**) for distributing the propellant into the decomposition chamber, and a nozzle 56 for exhausting the gas from the decomposition chamber, the nozzle having convergent portion, divergent portion and a throat portion, wherein: the first state is an opened state; the second state is a closed state; the second amount of propellant passed through the control valve during the second time is zero; the valve is continuously operated between the first and second states; a majority of the sum of the first amount plus the second amount of the propellant passed through the control valve during the first and second time period decomposes during the second time period [inherent, as the second time period can be much longer than the first time period]; and a current rate of decomposition of propellant in the decomposition chamber increases when the control valve changes from the first state to the second state; wherein the decomposition chamber comprises, a plurality of chamber beds having respectively sized particles of the catalyst, the chamber beds being graduated across a flow path through the decomposition chamber. The ranges for operation of the valve and thus the decomposition timing was regarded as inherent or taught by Ellion. To the extent that it is not specifically disclosed, it is regarded as an obvious matter of finding the workable ranges in the art as Ellion specifically controls the valve timing in a manner analogous to applicant. It would have been obvious to one of ordinary skill in the art to control the valve timing to perform the specific functions of

decomposition during the second time period, >90% decomposition, etc. as an obvious matter of finding the workable ranges in the art. It would have been obvious to one of ordinary skill in the art to employ the valve pulsing timing, the injector, the injector manifold and the use of plural catalyst beds, taught by Ellion, in order to prevent impulse bit degradation and allow enhanced performance, to employ conventional structure for injection of the monopropellant and to use plural beds to allow for separation of catalyst material and enhanced operation thereof.

10. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over any of the art applied above and further in view of Isley (3,603,093) and Hujsak (4,635,885). The above prior art teach various aspects of the claimed invention including a distribution manifold with the control valve but do not teach a flow control orifice disposed in the distribution manifold between the propellant tank and the control valve for limiting the flow of the propellant into the decomposition chamber. Isley teach a distribution manifold 14 with a flow restrictor R, 15 disposed in the distribution manifold between the propellant tank 12 and the control valve 18 for limiting the flow of the propellant into the decomposition chamber is well known in the art. The flow restrictor is not specifically described as a flow orifice though the flow orifice is one of the most common types of restrictors used in the art. Hujask teach a flow restrictor that is an orifice 60 is completely conventional. It would have been obvious to one of ordinary skill in the art to employ a flow restrictor orifice disposed in the distribution manifold between the propellant tank and the control valve of the above applied art, as taught by Isley and

Hujsak, as a conventional arrangement of a flow restrictor which enhances the pressure regulation of the flow into the valve.

11. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over any of the art including Runabot, Ellion et al (4,490,972) and incorporated by reference Ellion (4,324,**096**), and the Berg et al combination, as applied above to claim 1 and further in view of Moy (3,554,061). The above prior art teach the converging-diverging nozzle, but do not teach a throat valve. Moy teaches a throat valve 14 is well known in the rocket/thruster art for controlling the flow through the nozzle. It would have been obvious to one of ordinary skill in the art to employ a throat valve, as taught by Moy, in order to control the flow through the nozzle.

12. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over any of the art including Runabot, Ellion et al (4,490,972) and incorporated by reference Ellion (4,324,**096**), and the Berg et al combination, as applied above to claim 1 and further in view of Ellion (3,871,828). The above prior art teach various aspects of the claimed invention but do not teach the recirculation tube for routing a portion of the gas into the injector manifold for pushing the propellant into the decomposition chamber. Ellion '828 teach a recirculation tube for routing a portion of the gas into the injector manifold for pushing the propellant into the decomposition chamber (see col. 1, lines 18-21) is well known in the prior art. It would have been obvious to one of ordinary skill in the art to employ the recirculation tube, as it aids in the distribution of the propellant.

13. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over either Ellion et al (4,490,972) and incorporated by reference Ellion (4,324,**096**) or the Berg et al combination, as applied above to claim 17 and further in view of Moy (3,554,061) and of Ellion (3,871,828). The above prior art teach the converging-diverging nozzle, but do not teach a throat valve. Moy teaches a throat valve 14 is well known in the rocket/thruster art for controlling the flow through the nozzle. It would have been obvious to one of ordinary skill in the art to employ a throat valve, as taught by Moy, in order to control the flow through the nozzle. The above prior art teach various aspects of the claimed invention but do not teach the recirculation tube for routing a portion of the gas into the injector manifold for pushing the propellant into the decomposition chamber. Ellion '828 teach a recirculation tube for routing a portion of the gas into the injector manifold for pushing the propellant into the decomposition chamber (see col. 1, lines 18-21) is well known in the prior art. It would have been obvious to one of ordinary skill in the art to employ the recirculation tube, as it aids in the distribution of the propellant.

14. Claims 8, 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over either Ellion et al (4,490,972) and incorporated by reference Ellion (4,324,**096**) or the Berg et al combination as applied above, and further in view of Ellion et al (3,871,828). The prior art teach various aspects of the claimed invention including multiple catalyst beds but do not teach they are graduated in the direction of the flow. Ellion et al '828 teaches a similar thruster where the catalyst particles are graduated across the flow path (see col. 2, lines 65-col. 3, lines 2) is well known in the art. It would have been obvious to one of

ordinary skill in the art to graduate the catalyst particles, as taught by Ellion et al '828, in order to use an equivalent catalyst distribution used in the art.

Contact Information

Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Ted Kim whose telephone number is 571-272-4829. The Examiner can be reached on regular business hours before 5:00 pm, Monday to Thursday and every other Friday.

The fax number for the organization where this application is assigned is 571-273-8300.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Cuff, can be reached at 571-272-6778. Alternate inquiries to Technology Center 3700 can be made via 571-272-3700.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). General inquiries can also be directed to the Patents Assistance Center whose telephone number is 800-786-9199. Furthermore, a variety of online resources are available at http://www.uspto.gov/main/patents.htm

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